XFEL operation statistics

Hands on and some background

Raimund Kammering Hamburg, 28. Sep. 2021





Outline

How it started

- From the initial idee, to ...
- the early days at FLASH

Some technical background

- The TTFelog
- XSLT and such ugly stuff

The modern days

- From first elogbook based statistics at FLASH to
- these days statistics at XFEL
- Operators: Now it's your job

What it's used for

- Reports and the Statistics Dashboard
- Live presentation

What's missing

- Other statistics
- Shortcomings and a look to the future

Questions?

How it started

The very early days

- Already for the Tesla Test Facility TTF there was the attempt to follow performance parameters, like:
 - Downtimes of "NEW" Tesla type cavities, but also
 - other devices
- For tracking **cavity performance** already in the first days of TTF a Oracle based database (DB) has been set up: the *cavity DB*
- UI interface has been an **Oracle based forms** application
- That days all shift accounting has been done using this Oracle forms, but this was simply getting very clumsy



Some technical background

The TTFelog

- In 2001 the TTF electronic logbook was born
- Idee to more easy and better document actions taken on the facility
- Paper based logbooks where hard to maintain and there was strong increase in electronic based controls (remember that days TTF has been operated from Hall 3 extension, with oscilloscopes, ...)
- Build on the idea of using a printer queue to push content to some service and a web browser to view this content together with the new XML technology



From first elogbook based statistics at FLASH to

The initial idea

- In general an logbook is meant for *logging* events, or actions
- First ideas to do so using jddd buttons to fire commands to elogbook system to create a timestamped event entry
- In cooperation with K. Honkavaara and B. Faatz we developed the first panels and the backend for this approach in - hm was it 2011, or ...





these days statistics at XFEL

FLASH and XFEL are technically identical!

- Underlaying technique for both is still the same
- Much more categories exist at FLASH
- K. Honkavaara and J. Rönsch-Schulenburg set up lots of documentation on how to select categories
- With XFEL entering x-ray delivery Winni and me consolidated these and reduced the categorization dramatically



these days statistics at XFEL

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= Confluence Spaces - People	Create	Search	୍ ହ୍ 🕫 🚯					
XFEL Automated Statistics	Dashboard / XFEL Automated Statistics 🕯		hing < <u>S</u> hare …					
AFEL	Statistics based on operator input							
SPACE SHORTCUTS	Raimund Kammering posted on 30. Jun. 2020 09:29h - last edited by Raimund Ka	ammering on 01. Feb. 2021 17:50h						
Meeting notes	Data flow and overall architecture							
Documents	This statistic is evaluated based on input given by the operators. Operators are meant to tag, at least at shift start, the status of the							
High Level Controls	machine using the shown jddd panel.							
FEL Beam Dynamics Group Home	XFEL Statistics							
XFEL Operations								
Stash repository doocs based stats	Sink san/ Jakas charge							
PAGE TREE	Access, Seta, Turing							
> Documents	X-May Program? Na Streaked Down							
Meeting notes Statistics based on DOOOS histories								
 Statistics based on DOOCS histories Statistics based on operator input 								
	Image: Second	op hierarchy begin Facility Status with the folic	wing possible					
	Facility Status States							
	X-Ray Program							
	Access, Setup, Tuning							
	Facility Development							
	Scheduled Down							
	Unscheduled Down							
	Whereby the XFEL operation schedule is defining the overall status as FIXME what about unscheduled down in FD times? Within the X-Ray Program times the operators are in charge of followir users, may alter the machine state, between the states shown below:							
	X-Ray Program Sub-States							
	Delivery							
	Tuning							
	Down							

Operators: *Now it's your job*

Overview of all categories

Facility Status States automatically derived from Facility schedule									
X-Ray Pr	ogram	Access, Setup, Tuning Faci		cility Development Sche		eduled Down Un		cheduled Down	
	X-Ray Delivery Sub-States "always two there are";) no kidding: 3 possibilities								
	Delivery			Tuning			Down		
	Tuning Categories please select one!								
not_set	not_set Wavelength_change		Qualit	Quality Pointing		Pulse_energy Sp		pecial_mode	
	Down Categories this can be the tricky part								
not_set	Beam distribution or dumps	Controls	Coupler Interlocks	Cryogenics	Diagnostics	Experiments	Gun	HPRF	
Infrastructure	Laser	LLRF	Magnets	MPS or EPS	Operation	Undulator	Vacuum	Scheduled maintenance	

What it's used for

Reports and the Statistics Dashboard

Reports

- hmmm did not find it in the XFEL MAC reports
- FLASH uses this as main figure of merit in terms of availability to be presented in MAC and Betriebsseminar

Dashboard

- At least here it is used in the weekly summary
- Used Excel download to compare with N. Walker for Linac RF downtimes



What it's used for

Reports and the Statistics Dashboard

The Dashboard

• Let's have a look in real live:

https://flashwebsvr3.desy.de/XFEL-Statistics/



What's missing

Other statistics

There is a completely different approach using purely XGM intensity based data

- Developed by Elena Castro using Matlab
- took some time to get into agreement with operator based statistics, but now it's quite fine
- offers much deeper insides into SASE performance, but ...
- here no details about down and tuning times
- well documented in confluence:

https://confluence.desy.de/display/XAS/Statistics+based+on+DOOCS+histories

2021								
FEL SI	tates (theoretical) Puse E ranges							
	Photon E ranges	Low SASE Till 2020	SASE Till 2020	High SASE Till 2020	Low SASE 2021	SASE 2021	High SASE 2021	1
SA1	5-9.3 keV	Below	1 mJ +/- 50%	Above	Below	2 mJ +/- 20%	Above	
	>9.3-14 keV	Below	1 mJ +/- 50%	Above	Below	1 mJ +/- 20%	Above	
	>14 – 20 keV	Below	not defined	Above	Below	0.5 mJ +/- 20%	Above	
SA2	5.8-9.3 keV	Below	1 mJ +/- 50%	Above	Below	2 mJ +/- 20%	Above	
	>9.3-12 keV	Below	1 mJ +/- 50%	Above	Below	1 mJ +/- 20%	Above	
	>12 - 18 keV	Below	not defined	Above	Below	0.5 mJ +/- 20%	Above	
SA3	0.5-1.5 keV	Below	5 mJ +/- 50%	Above	Below	5 mJ +/- 20%	Above	
	>1.5-2.5 keV	Below	5 mJ +/- 50%	Above	Below	2 mJ +/- 20%	Above	
360 [m] Aguesau	Ter 200	Ľ	300		7000 - 6000 - Ind General 2009 2009 - 2000 -	500 500 741:200		

	Photon E ranges	Puse E ranges			
		Low SASE 2021	SASE 2021	High SASE 2021	
SA1	5- <mark>9.5</mark> keV	Below	2 mJ +/- 20%	Above	
	> <mark>9.5</mark> -14 keV	Below	1 mJ +/- 20%	Above	
	>14 – 20 keV	Below	0.5 mJ +/- 20%	Above	
SA2	5.8-9.5 keV	Below	2 mJ +/- 20%	Above	
	>9.5-12 keV	Below	1 mJ +/- 20%	Above	
	>12 – 18 keV	Below	0.5 mJ +/- 20%	Above	
SA3	0.5-1.5 keV	Below	5 mJ +/- 20%	Above	
	>1.5- <mark>3.5</mark> keV	Below	2 mJ +/- 20%	Above	

What's missing

Shortcomings and a look to the future

Just last week question came up

- "Are we less suffering from power glitches/cuts?"
- Browsed through downtimes looking for
 - Infrastructure
 - merged with 'Netzwischer' statistics from MKK
 - tried to match timestamp of 'Netzwischer' with down (any category)
- This failed completely for 2019, 2020 partly okay for 2021
- Reason just one example:
 - 'Netzwischer' on Monday, recovery took 20 h, still not 'leaking' into x-ray delivery time → not traceable with this approach!

Α	В	
	D	
38 2019-06-22 05:58:00	powerglitch	
139 2019-06-30 13:52:00	powerglitch	
140 2019-07-08 06:09:00	powerglitch	
145 2019-07-17 10:40:07	not_set	A16 trip, due to quench !
150 2019-07-18 15:55:00	not_set	
152 2019-07-20 18:53:00	powerglitch	
154 2019-07-22 06:25:00	not_set	
155 2019-07-23 15:00:00	not_set	
158 2019-07-24 16:48:46	-	gun tripped
160 2019-07-25 16:31:02	-	A17 tripped
161 2019-07-26 09:07:57		
163 2019-07-27 03:04:36		
164 2019-07-27 08:19:49	-	
165 2019-07-27 14:41:12	-	
176 2019-07-29 03:05:32		
177 2019-07-29 03:09:29		A4 quenched. FSM gave up after quenches
178 2019-07-29 03:59:59	-	
179 2019-08-02 05:19:00		
180 2019-08-02 06:24:00		
181 2019-08-03 05:14:00		
182 2019-08-06 15:23:10	-	
183 2019-08-06 17:28:16		
184 2019-08-06 18:12:09		
185 2019-08-06 18:24:26		
186 2019-08-07 12:32:50	-	
187 2019-08-07 15:00:00		
188 2019-08-08 03:05:49		
189 2019-08-08 04:41:32		
190 2019-08-09 04:52:41	-	
199 2019-08-13 12:17:00		
200 2019-08-13 23:00:00		
203 2019-08-16 17:46:39		
204 2019-08-17 08:43:02	-	
205 2019-08-17 10:37:00	powerglitch	
	l	

Thank you for your attention!

Questions/Comments?